CALIFORNIA DIVISION OF MINES AND GEOLOGY
FAULT EVALUATION REPORT FER-166

Ortigalita Fault
Fresno, Merced, San Benito, and Stanislaus Counties, California

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INTRODUCTION

The Ortigalita fault zone examined in this FER is located in portions of Stanislaus, Merced, Fresno, and San Benito Counties. Quadrangles in which the fault zone was examined are (from northwest to southeast) Crevison Peak, Pacheco Pass, San Luis Dam, Los Banos Valley, Ortigalita Peak N.W., Ortigalita Peak, and Cerro Colorado 7.5' quadrangles (Figure 1). The purpose of this study is to determine which strands of the Ortigalita fault are "sufficiently active and well-defined" to be zoned under the Alquist-Priolo Special Studies Zones Act (see Hart, 1980, p. 5-6).

SUMMARY OF AVAILABLE DATA

The Ortigalita fault was first mapped in reconnaissance fashion by Anderson and Pack (1915), who show it as the contact between the Franciscan Formation and the Chico Group (upper Cretaceous). Subsequent mapping by other workers (summarized below) demonstrates that the Ortilalita fault is a complex zone of reverse slip, oblique slip, and right-lateral strike-slip faults, with a long history of deformation. The Ortigalita fault is shown by Jennings (1975) to extend southward some 90 km from Orestimba Creek (where it apparently joins the Tesla fault) to Panoche Valley, and to be Quaternary-active south of Highway 152 at San Luis Reservoir. The northern segment of the fault is not evaluated here.

Leith (1949, Plate 1 and p. 28) mapped the Los Banos Valley 7.5-minute quadrangle as part of his Ph.D thesis on the Quien Sabe 15-minute quadrangle. He considers the Ortigalita fault to be a steeply southwest-dipping reverse fault (northeast side down) separating the Franciscan Group to the west from Cretaceous sandstone, shale, and conglomerate (Great Valley Sequence) to the east. A secondary parallel fault in the Franciscan Group lies immediately southwest of the Ortigalita fault. The secondary fault dips 50°-55° SW, with thrust movement indicated by poorly preserved slickensides. The amount of displacement on either fault was indeterminate. No faults are mapped by Leith in Holocene alluvium of Los Banos Valley. He gave no evidence for recent fault activity, and considered the Ortigalita fault to have been active mainly during late Pliocene time. The fault traces are not shown on Figure 2A as his mapping is similar to that of Dibblee (1975).

Briggs (1951, Plate 1 and p. 52) mapped the Ortigalita Peak and Ortigalita Peak NW 7.5-minute quadrangles as part of his Ph.D thesis on the Ortigalita Peak 15-minute quadrangle. He considered the Ortigalita thrust fault to be the most easterly fracture in a 2-4 km-wide zone of sheared Franciscan Group rocks, separating Franciscan Group rocks on the west from Cretaceous rocks

(Great Valley Sequence) on the east . Northeast of Ortigalita Peak the thrust fault dips 20°-30° to the southwest, gradually steepens north of Wisenor Flat, and becomes nearly vertical north of Piedra Azul Spring. The several northwest-trending faults in the zone are shown in cross-section to be reverse slip. The amount of displacement along the zone is not described other than as "extensive". According to Briggs, the thrust fault has not displaced the Tulare Fm. (late Pliocene-middle Pleistocene), but his geologic maps show the fault displacing (post-Tulare) Quaternary alluvium at two narrow creeks: 1) the southernmost channel at the east end of Wisenor Flat; and 2) Piedra Azul Creek in the vicinity of Piedra Azul Spring. [These two instances may be drafting errors.] His mapping is not known on Figures 2B and 2C.

Cotton (1972) prepared a reconnaissance geologic map (scale 1:62,500) of Franciscan assemblage rocks in the central part of the Diablo Range, including the Crevison Peak and Pacheco Pass 7.5-minute quadrangles. His map shows the Ortigalita fault as part of the "Tesla-Ortigalita fault" extending from Livermore Valley southward to San Luis Reservoir, separating Franciscan terrane (undifferentiated) on the west from unidentified (presumably Great Valley Sequence) rocks on the east. Sense of movement and amount of displacement along the fault are not indicated. No post-Cretaceous units are shown along the fault trace, nor is any evidence given of recent activity on the Ortigalita fault. His fault traces are shown on Figure 2A.

Dibblee characterizes the Ortigalita fault as a right-lateral, strike-slip fault (1980, p. 5), and also as a high-angle, primarily dip-slip fault (usually reverse movement, east side down), with local evidence of right-lateral movement (1981, p. 8-11). His geologic maps of the Pacheco Pass, Quien Sabe, and Ortigalita Peak 15-minute quadrangles (Dibblee, 1975) show the Ortiglita fault and its branch faults to be either dip slip (mostly east side down) or indeterminate, with a large graben forming Little Panoche Valley (Figures 2A, B, C). His map of the Panoche Valley 15-minute quadrangle shows the Ortigalita fault to be a right-lateral, strike-slip fault. Amounts of displacement on the faults are indeterminate. In Carrisalito Flat the Ortigalita fault is shown as concealed beneath Tulare Fm., but the fault displaces the Tulare Fm. in Little Panoche Valley (Ortigalita Peak and Panoche Valley quadrangles). The Ortigalita fault is inferred to cut older alluvium (Pleistocene) at the northwest end of Los Banos Valley (Quien Sabe quadrangle), and at the south end of Little Panoche Valley (Ortigalita Peak 15-minute quadrangle). Although the faults are mapped as concealed by Holocene alluvium at several locations, recent activity on the Ortigalita fault is inferred at one location south of Glaucophane Ridge in Panoche Valley. Evidence for recency is summarized on Figures 2A, B, C.

Lettis's 1982 Ph.D thesis is a detailed study of Late Cenozic stratigraphy within 23 7.5-minute quadrangles in the west-central San Joaquin Valley, and includes the south half of the Ortigalita fault. Although faults were mapped, the report concentrates on Quaternary stratigraphy, lithology, geomorphology, and pedology. The most important units identified by Lettis along the Ortigalita fault are Tulare Fm. (late Pliocene to mid-Pleistocene), Los Banos alluvium (mid- to late Pleistocene), San Luis Ranch alluvium (late Pleistocene to early Holocene), and Patterson alluvium (Holocene). The latter three are further subdivided, and are described in Figures 2B and C. He concluded that no significant uplift had occurred along the Ortigalita fault since Miocene time, because bodies of Quien Sabe Volcanics (Miocene) on both sides of the fault are at approximately the same elevation (Lettis, p. 167). However, his maps for Los Banos Valley, Ortigalita Peak, and Ortigalita Peak NW quadrangles show inferred vertical displacement for several of the Ortigalita fault traces. Lettis states (p. 167) that strike-slip and minor vertical displacement of Quaternary age is indicated by an alignment of springs, sag ponds, and weakly dissected escarpments in the Tulare Fm., Los Banos alluvium, and San Luis Ranch alluvium. He notes that San Luis Ranch alluvium is "clearly offset" near Piedra Azul and Molina Creeks (adjacent to Trench 2 of Anderson, La Forge, and Anders, 1982; below), and San Luis Ranch alluvium and probably Patterson alluvium are faulted in the headwater region of Little Panoche Creek (adjacent to Trench 1 of Anderson et al, 1982; below). Lettis concluded (p. 168) that lateral displacement on the Ortigalita fault is less than several tens of kilometers, due to the present locations of outlying bodies of Quien Sabe Volcanics relative to the main volcanic field.

Anderson and others (1982b) conducted a seimic hazard study of the late Quaternary faults in the eastern Diablo Range for the U. S. Bureau of Reclamation. Data on the Ortigalita fault is summarized by Anderson and others (1982a). The conclusions of Anderson and others (1982b) are based upon interpretation of small- and large-scale aerial photos, and on site-specific mapping and trenching of geologic and geomorphic features identified on the photos. This writer's analysis of the USBR report was hampered by the small-scale, poorly-printed base maps that accompanied the report. Additional unpublished maps (scale 1:24,000) of the Ortigalita fault were provided by Larry Anderson, USBR (1984, written communication). The fault traces (both published and unpublished) are shown on Figures 2A,B,C.

Anderson and others (1982b), divided the Ortigalita fault into four en echelon segments. From north to south, they are the Cottonwood Arm, Los Banos Valley, Piedra Azul, and Little Panoche segments (Figure 1).

Cottonwood Arm Segment (Figure 2A)

Tonal lineaments, notches and saddles, and a possible shutter ridge were identified along this segment between Highway 152 and Quinto Creek (Anderson and others, 1982b, p. 22, 32-34). The fault trace was projected southeastward across the reservoir to connect with a 3-km-long tonal lineament in Holocene(?) alluvium, a 300-m-long tonal lineament in late Pleistocene alluvium, and a bedrock tonal lineament at Goosehead Point.

Trenches 8, 9A, and 9B were excavated across the projected trace of the Ortigalita fault in the Cottonwood Arm section of San Luis Reservoir. Horizontal slickensides on faults exposed in trenches 8 and 9B indicate strike-slip displacement. Age of latest movement in Trenches 9A and 9B could not be determined due to the relative steepness of the ground slope. However all units in Trench 9A, including the A soil horizon, appear faulted or abruptly deformed, indicating probable Holocene faulting (Anderson and others, 1982b, Figure D-1). In Trench 8, San Luis Ranch alluvium (latest Pleistocene to Holocene) is faulted against Tulare Fm. gravels, and the overlying early Holocene(?) colluvium is faulted. The uppermost unit is unfaulted, and has a soil profile that indicated an age of 5,000-8,000 years. Most recent faulting is estimated by Anderson and others to have occurred between 5,000-8,000 years and 10,000 years B.P at Trench 8.

Los Banos Valley Segment (Figures 2A and B)

This 24 km segment extends southeastward from San Luis Creek to Carrisalito Flat (Anderson and others, 1982b, p. 22, 30-32, 36). North of San Luis Creek, features suggestive of faulting on the west side of San Luis Reservoir were not observed on the pre-construction photographs, but the alluvial fans are probably Holocene. A series of linear valleys (mainly in bedrock) coincide with the fault trace mapped by Dibblee (1975) south of Los Banos Valley. A 700-m-long scarp in the Tulare Formation (late Pliocene-middle Pleistocene) extends northwest from the active channel of Los Banos Creek, and a poorly defined lineament and occassional saddles or notches may define the fault to the northwest. A 7-km-long curvilinear scarp or terrace escarpment on the northeast side of Los Banos Valley is subparallel to Los Banos Creek.

Trench 7 was excavated across the projected trace of the Ortigalita fault at the northwest end of Los Banos Valley, and exposed a 20-m-wide shear zone in Panoche shale, Franciscan graywacke, schist, serpentinite, and colluvium. The faults are vertical to steeply dipping to the northeast, and trend N.45°-62°W. Two of the faults have horizontal slickensides, and confine a wedge of "older" colluvium. The entire zone is overlain by unfaulted soil. Based upon soil development, Anderson and others (1982b) estimate the date of most recent movement to be 10,000 to 15,000 years B.P.

Trench 4, which was only 6.5 m long, was excavated across the base of the southwest-facing 700-m-long scarp mentioned above, and exposed faulted Tulare Fm.(?)-derived colluvium. The steeply northeast-dipping fault zone flattens upward, and is overlain by unfaulted dark brown colluvium (Anderson and others, 1982b, Figure B-4). Anderson and others were unable to estimate the age of most recent faulting. Anderson (unpublished map) does not show this trench but notes: "SW-facing scarp, (approximately) 7m, apparent vertical displacement".

Trench 3 was excavated northeast of Trench 7 across the northwest end of the 7-km-long scarp on the north side of Los Banos Valley, exposing a steeply-dipping fault that trends N 57° W. Anderson and others (1982b) named this fault segment the Los Banos Creek fault. [Anderson (unpublished) does not show this fault.] Although no slickensides were found on the fault plane, strata of the Tulare Fm.(?) have been dragged downward against shale of the Great Valley Sequence, indicating normal faulting. [The log for Trench 3 indicates that the thin-bedded shale of the Great Valley Sequence (Panoche Shale) is vertical or steeply dipping, possibly indicating that strike-slip or oblique-slip has occurred.] The fault zone is overlain by unfaulted colluvium whose soil profile development suggests an age of deposition of 15,000 to 20,000 years B.P.

Piedra Azul Segment (Figure 2B)

This segment extends 20 km southeastward from Carrisalito Flat to the north end of Little Panoche Valley (Anderson and others, 1982b, p. 21, 27-30). A possible shutter ridge and east-facing scarp mark the location of the Ortigalita fault at the east side of Wisenor Flat. A strong tonal lineament (ground water barrier?) was seen in alluvium of Wisenor Flat west of the shutter ridge, and a vegetation contrast (visible on color IR air photos) extends northwest across Carrisalito Flat. In line between these two areas are a northwest trending linear valley southeast of Carrisalito Flat and a one-km-long west-facing escarpment near Piedra Azul Spring. Strong tonal contrasts (probably between different bedrock types) were observed between Piedra Azul Spring and Little Panoche Valley.

Trench 2 was excavated across the northwest-trending escarpment in San Luis Ranch alluvium (latest Pleistocene-Holocene) north of Piedra Azul Spring (Figure 2B). The trench exposed a possible sag pond (^{14}C date of 9,970 years B.P.) at the base of the escarpment, but no fault plane was identified in the trench. [The log also shows apparently deformed beds at the base of the escarpment.]

Trench 5 was excavated 2km to the northwest, at the base of the southwest-facing escarpment at the southwest edge of Carrisalito Flat (Figure 2B). It exposed two zones of strike-slip or oblique slip faulting in Tulare Fm. (late Pliocene to mid-Pleistocene). The west fault changed dip from nearly vertical to nearly horizontal in a horizontal distance of two meters; the fault either "daylighted" at a lower elevation or was overturned by downhill creep of the colluvium. Both faults are overlain by apparently unfaulted colluvium with a soil profile that indicates the colluvium is 35,000-40,000 years old. [Holocene activity is possible if the fault "daylighted" as indicated above.]

Little Panoche segment, Figures 2B and C)

This segment extends from the north end of Little Panoche Valley to the north end of Panoche Valley, a distance of 17 km, (Anderson and others, 1982b, p. 21, 24-27). On the west side of Little Panoche Valley, an east-facing escarpment probably marks the fault location. Young alluvial fans have buried most evidence of recent faulting, but a small graben-like feature and a short east-facing scarp were identified and trenched (see below). The east side of Little Panoche Valley contains several prominent west-facing scarps along with some tonal contrasts (ground-water barriers?) near the more prominent scarps. No strong linear features were observed along the southwest side of Glaucophane Ridge at the north end of Panoche Valley. To the south, between Mine Creek and Glaucophane Ridge (Cerro Colorado quadrangle, Figure 2C), a series of north-trending west-facing scarps and linear drainages were identified.

Trench 1 was excavated across a 20-m-wide graben, and exposed two north-trending faults nearly coincident with the mapped boundaries of the graben (see Figure 4). The eastern fault is nearly vertical and shows 1.5 to 2 m displacement (down to the west) of beds that are estimated to be as young as 1,000 to 3,000 years, based upon the lack of soil development. The uppermost unit, which formed less than 900 years B.P. (based upon ^{14}C dating), reportedly was not faulted although the trench log shows the base of the unit to be downwarped across the eastern trace. The western fault dipped steeply east and has offset only the oldest exposed unit, which was estimated to be less than 250,000 to 500,000 years old. The youngest unit was not offset.

Based upon data summarized above, Anderson, and others (1982b, p. 77) reached the following conclusions concerning the Ortigalita fault:

A) The Ortigalita fault has had recurrent, primarily right-lateral movement during the late Quaternary.
B) The fault consists of four en echelon segments, each of which has evidence of a different age of most recent movement, and a different recurrance interval between events.
C) Geologic evidence indicates that surface fault-rupture occurs at intervals of 2,000 to 5,000 years for the fault as a whole, and at intervals of 10,000 to 25,000 years for individual segments.
D) Based upon seismic data for the period 1969-1981, an event of M = 6.75 has a recurrence interval of 18,000 years, and surface fault rupture for the entire fault has a recurrence interval of 800 to 3,000 years. [This latter statement is in conflict with C above]

INTERPRETATION OF AIR PHOTOS AND FIELD OBSERVATIONS

Geomorphic features along the mapped traces of the Ortigalita fault that provide evidence of recent faulting include shutter ridges, offset drainages, closed depressions or sag ponds, ponded alluvium, linear trenches, scarps, sidehill benches, linear drainages, and ridge saddles or notches. All of these features, according to Slemmons (1977, p. A-17) are typical geomorphic features associated with active strike-slip faulting and are shown on Figures 3A and B of this report.

One set of aerial photographs were available to the author: U.S. Department of Agriculture, 1950, series ABF and ABI, black and white, scale 1:20,000. Air photo coverage was limited to the Ortigalita fault south of Quinto Creek. In addition, field observations were made selectively during five days in October and November 1984, partly in the company of Earl Hart. Hart also provided interpretations of recent faulting which are partly incorporated in figures 3A and 3B.

For the purpose of discussion, the Ortigalita fault is divided into four segments which correspond with the designations of Anderson, and others (1982b). These are (from north to south) Cottonwood Arm segment, Los Banos Valley segment, Piedra Azul segment, and Little Panoche segment. Each segment is further subdivided as necessary for clarity.

COTTONWOOD ARM SEGMENT

North of Highway 152

The fault trace north of Highway 152 to the Bald Eagle Mine shows abundant geomorphic evidence of right-lateral, strike-slip displacement. An alignment of shutter ridges, right-laterally deflected drainages, scarps, saddles, and other features accurately define the location of the fault in most places (Figure 3A). The interpreted location is similar to the faults mapped by Dibblee (1975), Anderson and others (1982b), and, in part, Cotton (1972). Although air photos were not available for the fault northwest of the Bald Eagle Mine to the west edge of the Crevison Peak 7.5-minute quadrangle, several ridges and drainages shown on the topographic map appear to be right-laterally deflected along the fault trace of Dibblee (1975). Recent activity along the fault trace of Cotton (1972) north of Romero Creek was not verified on the air photos. Three trenches (8,9A, and 9B of Anderson and other, 1982b) exposed the fault and yielded horizontal slickensides and data indicating Holocene activity.

South of Highway 152

The active fault is sparsely defined by tonals, southwest-facing scarps, and right-laterally deflected drainages in Holocene alluvium of Dibblee (1975). Accurate plotting of these features was hindered in the reservoir area by a lack of reference points. The fault becomes increasingly difficult to follow southward, apparently as it steps right (westward) to the Los Banos Creek segment. The tonal contrast and the concealed trace mapped by Anderson and other (1982b) south of Highway 152 could not be verified on the available photographs (Figure 2A). At Goosehead Point, a shallow linear drainage in Holocene alluvium of Dibblee (1975) is aligned with a tonal in bedrock. No evidence of recent faulting southeast of Goosehead Point was seen on the photographs.

The concealed faults mapped by Cotton (1972) and Dibblee (1975) in the reservoir could not be verified on the air photos (Figure 2A). Evidence of recent activity was not visible on the photos for the southeast-trending fault at Quien Sabe Point mapped by Dibblee.

LOS BANOS CREEK SEGMENT

North of Los Banos Creek

The connection northward with the Cottonwood Arm segment is a large right step across San Luis Reservoir, which fills a basin that apparently has been pulled apart approximately 5 Km in a northwest direction. Northwest of San Luis Creek, several southwest-facing scarps, a closed depression, tonals, and right-laterally-deflected drainages are aligned in Holocene alluvium of Dibblee (1975), but they generally do not coincide with the concealed fault traces of Anderson and others (1982b), Cotton (1972), or Dibblee (1975; see Figures 2A and 3A). The right-step connection to the recently active strand south of San Luis Creek is concealed by young alluvium; or perhaps it may not even exist as a surface trace. This area is now concealed by water from the San Luis Reservoir. Between San Luis Creek and Los Banos Creek (Figures 3A and B), evidence suggestive of recent faulting includes an alignment of springs, right-laterally-deflected drainages, scarps, and other features. Several southwest-facing scarps, including one in Holocene alluvium of Lettis (1982), align with the fault zones exposed in Trenches 4 and 7 of Anderson and others (1982b). This segment generally follows the traces mapped by Anderson and others (1982b), Dibblee (1975), and Lettis (1982).

South of Los Banos Creek

Los Banos Creek apparently has been offset right-laterally more than 5 km by the Ortigalita fault. Immediately south of Los Banos Creek, the trace is concealed by modern alluvium. Farther south, the segment is moderately well defined by an alignment of tonals, right-laterally-deflected drainages, saddles, linear drainages, and sidehill benches (Figure 3B). This segment largely coincides with the mapping of Dibblee (1975), and Anderson and others (1982b), but not that of Lettis (1982). Lettis's southeast-trending fault to the east (Figure 2B) was not verified on the air photos as recently active.

Along the northwest margin of Carrisalito Flat, an alignment of linear drainages, vertical shear fabric in serpentinite, tonals, and low southwest-facing scarps in latest Pleistocene to Holocene alluvium identify the southern end of the Los Banos Creek segment. The concealed traces of Dibblee (1975) and Anderson and others (1982b) could not be verified in this area.

Los Banos Creek Fault of Anderson and others (1982b)

Near Trench 3 of Anderson and others (Figure 3B), a series of linear drainages, tonals, linear troughs, and southwest-facing scarps in mid- to late Pleistocene alluvium of Lettis (1982), align with the steeply dipping fault exposed in Trench 3. According to Anderson and others (1982b; summarized above), the fault is overlain by unfaulted colluvium believed to be 15,000 to 20,000 years old. In addition, southeast of Trench 3 is a series of southwest-facing scarps (only partly mapped) in the mid- to late Pleistocene alluvium that generally align with the fault. However, most of these scarps appear to be erosional.

Piedra Azul Segment

Evidence permissive of a connection between the Piedra Azul segment and the Los Banos Creek segment at Carrisalito Flat are an alignment of north-trending saddles, tonals, break-in-slope, and a faceted spur north of Herrero Canyon (Figure 3B). Along the western margin of Carrisalito Flat, tonals and east-facing scarps in latest Pleistocene to Holocene alluvium partly coincide with the traces of Lettis (1982) and Anderson and others (1982b). From Carrisalito Flat southeastward to Wisenor Flat, the fault can be traced as an alignment of linear troughs and drainages, scarps, shutter ridges, right-laterally-deflected drainages, saddles, and tonals.

A sequence of linear drainages, scarps, and other features extends southeastward from Piedra Azul Spring in alluvial units (that are considered by Lettis (1982) to be of mid- to late Pleistocene or latest Pleistocene to Holocene age). This alignment of geomorphic features joins a south-southeast-trending alignment of linear drainages, saddles, and right-laterally-deflected drainages in bedrock north of Wisenor Flat. A tonal in latest Pleistocene to Holocene alluvium of Lettis (1982) is at the end of the bedrock alignment, at the north-central margin of Wisenor Flat. The best evidence for recent faulting at the east end of Wisenor Flat is a bedrock shutter ridge with northeast-facing scarp that aligns with other features in latest Pleistocene to Holocene alluvium of Lettis (1982).

This segment of the Ortigalita fault could not be traced on the air photos as a well defined, recently active feature between Wisenor Flat and Little Panoche Valley, and its connection with the Little Panoche segment is unclear.

LITTLE PANOCHE SEGMENT

West Side Trace

North of Mine Creek, a subtle alignment of low scarps, right-laterally deflected drainages, linear troughs, tonals, and other features in latest Pleistocene and Holocene alluvium of Lettis (1982) are strongly suggestive of a Holocene fault with right lateral displacement. The features align with the two faults exposed in Trench 1 of Anderson and others (1982b; see above). These features partly coincide with traces mapped by Lettis (1982), Dibblee (1975), and Anderson and others (1982b). The fault was difficult to follow to the northwest, where it connects with the Piedra Azul segment.

South of Mine creek to Vasquez Creek (Cerro Colorado quadrangle, Figure 2C), the faults of Dibblee (1975) and Anderson and others (1982b) could be verified only generally as a broad zone of low, discontinuous west-facing scarps, saddles, and short linear drainages. The drainages across these features were not systematically offset, suggesting that activity on this strand of the Ortigalita fault dies out southward near the south margin of the Ortigalita Peak quadrangle. No evidence of recent activity was seen on the air photos for the traces south of Vasquez Creek (Figure 2C).

East Side Trace

The fault segment shown by Dibblee (1975), Lettis (1982), and Anderson and others (1982b), south of the center of sec. 28, T. 13 S., R. 10 E., showed good evidence of recent faulting, including well-defined scarps, tonals, lineaments, and a closed depression in Holocene and late Pleistocene alluvium (Figure 3B). The faults shown north of the center of sec. 28 (Figure 2C) could not be verified on the air photos. A southeast-trending fault in sec. 33, mapped by Lettis (1982) as displacing mid- to late Pleistocene alluvium, was not verified as recently active (Figure 2C). South of Mine Creek (Figure 2C), the concealed faults of Dibblee (1975) could not be verified on the air photos.

SEISMICITY

The Ortigalita fault is closely aligned with numerous post-1969 earthquakes (Anderson and others, 1982b; La Forge and Lee, 1982). The alignment of epicenters is best defined from Little Panoche Valley to San Luis Reservior. The largest earthquake clearly associated with the Ortigalita fault appears to be a M. 3.7 event that occurred just south of San Luis Reservoir in May 1981. La Forge and Lee (1982) demonstrate that most of the seismic activity along the fault during the period 1969-1981 indicates (right-lateral) strike-slip movement, although some reverse and normal faulting apparently has occurred at the south end of the San Luis Reservior area. A clustering of events occurs at the north end of Little Panoche Valley, where the strike of the fault abruptly changes.

CONCLUSIONS

The Ortigalita fault is a complex zone of reverse, normal, and right-lateral strike-slip faults with a long history of deformation. Recent displacement along the fault is largely confined to four relatively well defined, en echelon segments, each of which has evidence of Holocene or latest Pleistocene rupture. The Ortigalita fault is closely aligned with numerous post-1969 earthquakes, with the alignment of epicenters best defined from Little Panoche Valley north to San Luis Reservoir. First motion studies indicate principally right-lateral slip along the fault.

Late Quaternary activity along the segments of the Ortigalita fault has been dominated by right-lateral displacement with local components of dip-slip (both normal and reverse). The maximum amount of strike-slip displacement in Quaternary time appears to be at least 5 km at Los Banos and San Luis Creeks, based on geomorphic relations. North of San Luis Reservoir, abundant geomorphic evidence of recent right-lateral strike-slip faulting in bedrock is visible on air photos and in the field. Recent faulting is indicated by geomorphic features in Holocene alluvium or latest Pleistocene to Holocene alluvium in San Luis Reservoir, Los Banos Valley, Carrisalito Flat, Piedra Azul Creek, Wisenor Flat, and in Little Panoche Valley north of Mine Creek. Evidence indicative of recent faulting south of Mine Creek could not be verified. Holocene or latest Pleistocene activity, based on trench observations of Anderson and others (1982b), has been documented locally for each of the fault segments mapped.

The Los Banos Creek fault of Anderson and others (1982b) appears to be relatively well-defined in the northwest segment near Trench 3, and is exposed in the trench. However, the southeast segment is mapped along the base of a south-facing escarpment along Los Banos Creek, and appears to be erosional in origin. The fault in Trench 3 is overlain by unfaulted colluvium that Anderson and others estimate to be 15,000 to 20,000 years old.

RECOMMENDATIONS

The segments of the Ortigalita fault mapped or compiled by this writer and shaded in orange on Figures 3A and 3B, should be zoned. In addition, fault traces of Anderson, et al (1982) shown in red on Figures 3A and 3B should be zoned to provide continuity between this writer's fault segments. References cited should include this report, Anderson and others (1982a, 1982b), and Dibblee (1975). Zoning is not recommend on the Cerro Colorado quadrangle where the Ortigalita fault is poorly defined.

The Los Banos Creek fault of Anderson and others (1982b) lacks adequate evidence of Holocene activity and does not meet the requirements, and should not be zoned.

The O'Neill and other faults shown by Lettis (1982) and Anderson and others (1982b) to the east of the Ortigalita fault, should be evaluated in a separate FER if time permits.

Reviewed; recommendations are appropriate.
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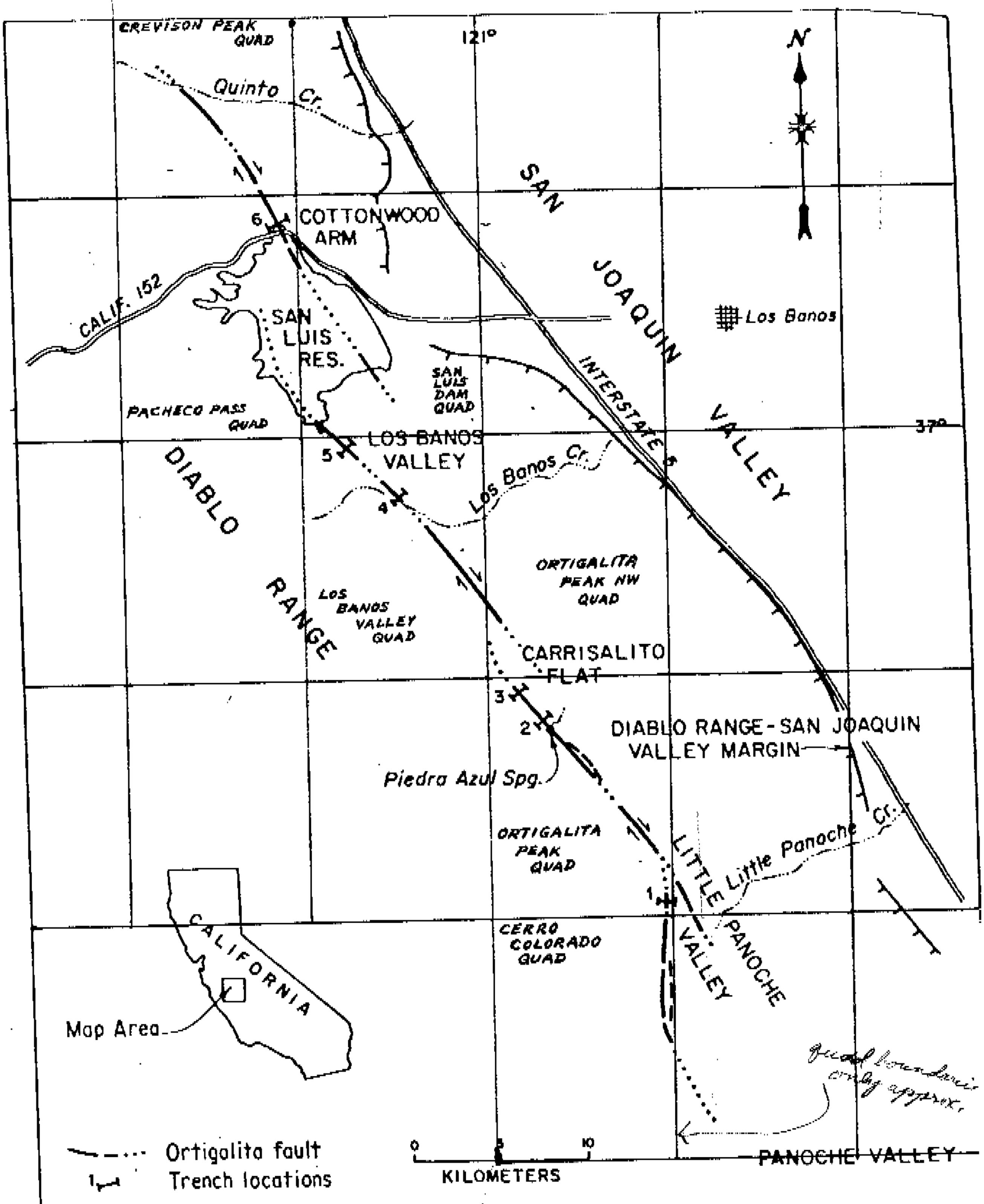

FIGURE 1. THE ORTIGALITA FAULT IN THE EASTERN DIABLO RANGE.
(FER-166)